

FORM PTO-1390
(REV 10-94)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

878.47USWO

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)

to be assigned

09/890917

INTERNATIONAL APPLICATION NO.

PCT/ZA00/00019

INTERNATIONAL FILING DATE

February 8, 2000

PRIORITY DATE CLAIMED

February 8, 1999

TITLE OF INVENTION

TIMBER PROCESS AND PRODUCT

APPLICANT(S) FOR DO/EO/US

Sydney MABOKA

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ UNSIGNED An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: International Preliminary Examination Report, International Search Report, Abstract, marked-up copy of the claims

U.S. APPLICATION NO (If known, see 37 CFR 1.5) to be assigned 09/890917		INTERNATIONAL APPLICATION NO PCT/ZA00/00019		ATTORNEY'S DOCKET NUMBER 878.47USWO	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a) (1)-(5)): Search Report has been prepared by the EPO or JPO.....\$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.492(a)(1)).....\$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$710.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(3)) paid to USPTO \$1000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)\$100.00				CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	16 -20 = 0		X \$18.00	\$0.00	
Independent claims	1 -3 = 0		X \$80.00	\$0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$860.00	
Reduction by 1/2 for filing by small entity, if applicable. Small entity status is claimed pursuant to 37 CFR 1.27				\$0.00	
SUBTOTAL =				\$860.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+ \$0.00	
TOTAL NATIONAL FEE =				\$860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				+ \$0.00	
TOTAL FEES ENCLOSED =				\$860.00	
				Amount to be:	
				refunded	\$0.00
				charged	\$0.00
a. <input checked="" type="checkbox"/> Check(s) in the amount of <u>\$860.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>13-2725</u> .					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO Brian H. Batzli MERCHANT & GOULD P.O. Box 2903 Minneapolis, MN 55402-0903			SIGNATURE: <u>2.24.01</u> NAME: Brian H. Batzli REGISTRATION NUMBER: 32,960		

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

1020 Rec'd PCT/PTO 07 AUG 2001

09/890917

Applicant: Sydney Maboka
Docket: 878.47USWO
Title: TIMBER PROCESS AND PRODUCT

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL669945117US

Date of Deposit: August 7, 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 and is addressed to the Commissioner for Patents, Washington, D.C. 20231.

By: Omesh Singh
Name: Omesh Singh

BOX PCT
Commissioner for Patents
Washington, D.C. 20231

Sir:

We are transmitting herewith the attached:

- ☒ Transmittal sheet, in duplicate, containing Certificate under 37 CFR 1.10.
- ☒ National Stage PCT Patent Application: Spec. 13 pgs; 16 claims; Abstract 1 pgs.
The fee has been calculated as shown below in the 'Claims as Filed' table.
- ☒ An unsigned Combined Declaration and Power of Attorney
- ☒ A check in the amount of \$860.00 to cover the Filing Fee
- ☒ Other: form PTO-1390, preliminary amendment, International Preliminary Examination Report, International Search Report, marked-up copy of the claims, substitute specification
- ☒ Return postcard

CLAIMS AS FILED

Number of Claims Filed		In Excess of:		Number Extra		Rate		Fee
Basic Filing Fee								\$860.00
Total Claims								
16	-	20	=	0	x	18.00	=	\$0.00
Independent Claims								
1	-	3	=	0	x	80.00	=	\$0.00
MULTIPLE DEPENDENT CLAIM FEE								\$0.00
TOTAL FILING FEE								\$860.00

Please charge any additional fees or credit overpayment to Deposit Account No. 13-2725. A duplicate of this sheet is enclosed.

MERCHANT & GOULD P.C.
P.O. Box 2903, Minneapolis, MN 55402-0903
(612) 332-5300

By: Brian H. Batzli
Name: Brian H. Batzli
Reg. No.: 32,960
Initials: BHBatzli/sef



(PTO TRANSMITTAL - NEW FILING)

S/N unknown

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Sydney MABOKA	Docket No.:	878.47USWO
Serial No.:	unknown	Filed:	concurrent herewith
Int'l Appln No.:	PCT/ZA00/00019	Int'l Filing Date:	February 8, 2000
Title:	TIMBER PROCESS AND PRODUCT		

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL669945117US

Date of Deposit: August 7, 2001

I hereby certify that this correspondence is being deposited with the United States Postal Service 'Express Mail Post Office To Addressee' service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

By:

Name: Omesh Singh

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment, which is based on the Article 36 amendments, based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report, a copy of which is enclosed herewith:

IN THE ABSTRACT

Insert the attached Abstract page into the application as the last page thereof.

IN THE SPECIFICATION

A courtesy copy of the present specification is enclosed herewith. However, the World Intellectual Property Office (WIPO) copy should be relied upon if it is already in the U.S. Patent Office. A substitute specification is enclosed.

IN THE CLAIMS

Please amend claims 3-14 and 16 as follows:

3. (amended) A binding mixture as claimed in claim 1, wherein the or each polyurethane catalyst(s) is/are (a) delayed-action catalyst(s).

4. (amended) A binding mixture as claimed in claim 1, wherein an effective amount of toluene di-isocyanate ("TDI") is added to the MDI.

5. (amended) A binding mixture as claimed in claim 1, wherein one or more internal wetting and release agents is/are added to the mixture.

6. (amended) A binding mixture as claimed in claim 1, wherein a suitable quantity of one or more than one polyol(s) is/are added.

7. (amended) A binding mixture as claimed in claim 1, wherein the amount of formaldehyde in the UF may be approximately 50% (in moles).

8. (amended) A binding mixture as claimed in claim 1, wherein the or each suitable amine(s) or amine compound(s) are selected from the following:

2-dimethyl ethanolamine ("DMEA");

di-amino bicyclo-octane ("DABCO"); and

N,N-dimethyl cyclohexylamine ("DMCHA").

9. (amended) A binding mixture as claimed in claim 1, wherein the or each suitable organometallic tin-based compound(s) is/are selected from the following:

Stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

10. (amended) A binding mixture as claimed in claim 1, wherein the suitable organometallic compound(s) include ferric acetylacetonate.

11. (amended) A binding mixture as claimed in claim 1, wherein the suitable alkali metal salt(s) are selected from the following:

calcium carbonate, salts of carbonic acid, and salts of acetic acid.

12. (amended) A binding mixture as claimed in claim 1, wherein the amount of MDI required to effect a suitable hastening of the curing process is in the range of from about 0.1% to 1.9% of bone dry wood ("BDW").

13. (amended) An additive for a UF binding mixture for use in manufacturing chipboard, the additive including an effective amount of MDI and a catalyst, each catalyst being as claimed in claim 1.

14. (amended) A process for manufacturing chipboard, the process including the steps of using a binding mixture as claimed in claim 1, and suitably mixing the binding mixture with wood particles and/or chips.

16. (amended) Chipboard whenever manufactured by using a binding mixture, an additive for a binding mixture, or a process for manufacturing chipboard, respectively, as claimed in claim 1.

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 3-14 and 16. A marked-up copy of the claims is attached.

A new abstract page is supplied to conform to that appearing on the publication page of the WIPO application, but the new Abstract is typed on a separate page as required by U.S. practice.

Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

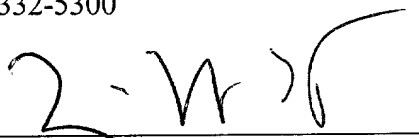
If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Brian H. Batzli (Reg. No. 32,960), at (612) 336.4755.

Respectfully submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, Minnesota 55402-0903
(612) 332-5300

Dated: August 7, 2001

By



Brian H. Batzli
Reg. No. 32,960

BHB/jlc

ABSTRACT

This invention provides a binding mixture for use in manufacturing chipboard, the mixture including an effective amount of methyl di-isocyanate ("MDI") and one or more polyurethane catalyst(s) being selected from the following: (a) one or more amine compound(s) including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and /or alcohols; or (b) one or more organometallic compounds of tin, bismuth, zinc, iron, and/or alkali metal salt(s); or (c) suitable mixtures of (a) and (b) above.

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Marked-up version of claims pg 1/4

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CLAIMS

1. A binding mixture for use in manufacturing chipboard, the mixture including urea-formaldehyde resin ("UF"), an effective amount of methyl diisocyanate ("MDI") and one or more polyurethane catalyst(s) being selected from the following:
 - (a) one or more amine compounds including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and/or alcohols; or
 - (b) one or more organometallic compounds of tin, bismuth, zinc, iron, and/or alkali metal salt(s); or
 - (c) suitable mixtures of (a) and (b) above.
2. A binding mixture as claimed in claim 1, wherein the MDI is water-emulsifiable.
3. A binding mixture as claimed in ⁴either claim 1 or claim 2, ⁵wherein the or each polyurethane catalyst(s) is/are (a) delayed-action catalyst(s).

--claim 1--

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Marked-up version of claims pg 2/4

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4. A binding mixture as claimed in "any one of the preceding claims," --claim 1-- wherein an effective amount of toluene di-isocyanate ("TDI") is added to the MDI.
5. A binding mixture as claimed in "any one of the preceding claims," --claim 1-- wherein one or more internal wetting and release agents is/are added to the mixture.
6. A binding mixture as claimed in "any one of the preceding claims," --claim 1-- wherein a suitable quantity of one or more than one polyol(s) is/are added.
7. A binding mixture as claimed in "any one of the preceding claims," --claim 1-- wherein the amount of formaldehyde in the UF may be approximately 50% (in moles).
8. A binding mixture as claimed in "any one of the preceding claims," --claim 1-- wherein the or each suitable amine(s) or amine compound(s) are selected from the following:

2-dimethyl ethanolamine ("DMEA");

di-amino bicyclo-octane ("DABCO"); and

N,N-dimethyl cyclohexylamine ("DMCHA").

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Marked-up version of claims pg 3/4

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9. A binding mixture as claimed in ["]any one of the preceding claims["] ^{---claim 1---}, wherein the or each suitable organometallic tin-based compound(s) is/are selected from the following:

Stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

10. A binding mixture as claimed in ["]any one of the preceding claims["] ^{---claim 1---}, wherein the suitable organometallic compound(s) include ferric acetylacetonate.

11. A binding mixture as claimed in ["]any one of the preceding claims["] ^{---claim 1---}, wherein the suitable alkali metal salt(s) are selected from the following:
- calcium carbonate, salts of carbonic acid, and salts of acetic acid.

12. A binding mixture as claimed in ["]any one of the preceding claims["] ^{---claim 1---}, wherein the amount of MDI required to effect a suitable hastening of the curing process is in the range of from about 0.1% to 1.9% of bone dry wood ("BDW").

13. An additive for a UF binding mixture for use in manufacturing chipboard, the additive including an effective amount of MDI and a catalyst, each catalyst being as claimed in ["]any one of the preceding claims["] ^{---claim 1---}.

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Marked-up version of claims pg 4/4

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14. A process for manufacturing chipboard, the process including the steps of using a binding mixture as claimed in "any one of claims 1 to 12, and suitably mixing the binding mixture with wood particles and/or chips.

"--claim 1--

15. A process for manufacturing chipboard, the process including the steps of adding to or using in a UF binding mixture an effective amount of an additive as claimed in claim 13, and suitably mixing the binding mixture with wood particles and/or chips.

16. Chipboard whenever manufactured by using a binding mixture, an additive for a binding mixture, or a process for manufacturing chipboard, respectively, as claimed in "any one of the preceding claims.

"--claim 1--

AMENDED SHEET

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TIMBER PROCESS AND PRODUCT

INTRODUCTION

This invention relates to a timber process and product. More particularly this invention relates to a process for manufacturing so-called particle board or chipboard, and to a timber product in the form of such particle board or chipboard when manufactured by or from the aforementioned process.

BACKGROUND TO THE INVENTION

It is known in the manufacture of particle board or chipboard (hereinafter referred to as "chipboard") that a urea-formaldehyde resin (hereinafter referred to as "UF") is used as a binder or adhesive to bond the particles or chips of wood.

Typically such binders contain approximately 55% to 60% formaldehyde (in moles) but because of recent awareness of the health problems associated with the use of formaldehyde, the amount of formaldehyde in such resins is generally being reduced. Hence the amount of formaldehyde in the aforementioned resins has been reduced to approximately 50% or less (in moles).

The aforementioned resins need to be cured, and the curing process is accelerated by heating in a press under pressure i.e. heat is applied by hot metal platens on both sides of a so-called mat of glued chips. Such chipboard pressing takes place either in a batch-type (using daylight presses) or in a continuous process i.e. using continuous (for example roller) presses.

It is also known in the chipboard industry that isocyanates especially methyl diisocyanate (hereinafter referred to as "MDI") may be added to the aforementioned type of resin to hasten the curing process i.e. to effectively increase the speed of the curing process and hence to reduce the curing time. However, because of the high cost of MDI and the amount required to effectively hasten the curing process, the use of MDI is not cost-effective on an industrial scale.

OBJECTS OF THE INVENTION

It is accordingly a general object of the present invention to provide an improved binding mixture for chipboard manufacture.

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It is also an object of the present invention to provide an improved process in which such improved mixture is used, which is both cost-effective and which increases the efficiency and rate of curing of the binding mixture.

It is a further object of the invention that the aforementioned binding mixture and process will lead to an increase in productivity or production flowing from shorter curing periods resulting from use of the aforementioned binding mixture.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a binding mixture for use in manufacturing chipboard, the mixture including UF, an effective amount of MDI and one or more polyurethane catalyst(s) being selected from the following:

- (a) one or more amine compound(s) including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and/or alcohols; or
- (b) one or more organometallic compound(s) of tin, bismuth, zinc, iron and/or alkali metal salt(s); or
- (c) suitable mixtures of (a) and (b) above.

The MDI may or may not be water-emulsifiable, and the or each polyurethane catalyst(s) may or may not be (a) delayed-action catalyst(s).

To the mixture may be added an effective amount of toluene di-isocyanate ("TDI") and/or one or more internal wetting and release agents.

The aforementioned mixture(s) may of course include a suitable amount of UF which may or may not have suitable quantities of polyol(s) added thereto. It is to be noted that the UF (with or without polyol(s), MDI and catalyst(s) mixture may be used as a core-layer glue mixture for a three-layer chipboard. The addition of isocyanate(s) and catalyst(s) to the core-layer glue mixture does not imply that the normal additives added to the UF (such as hardeners and wax) need to be excluded from the mixture. A surface layer glue mixture may consist of UF, hardener, wax and any other suitable additive(s) which either control tack or pre-curing of the glued wood chips.

The amount of formaldehyde in the aforementioned urea-formaldehyde resin may preferably be approximately 50% (in moles) i.e. may be less than, equal to, or more than 50% (in moles).

By using a catalyst as aforementioned, the effective amount of MDI required may be reduced relative to amounts known to be used in the prior art. In addition, by using a suitable catalyst as aforementioned, the rate of production of chipboard

may be improved considerably as compared to performance by other formulations forming part of the prior art."

Suitable amines or amine compounds may be selected from the following:

2-dimethyl ethanolamine (hereinafter referred to as "DMEA");
di-amino bicyclo-octane (hereinafter referred to as "DABCO"); and
N,N-dimethyl cyclohexylamine (hereinafter referred to as "DMCHA").

Suitable organometallic tin-based compounds may be selected from the following:

stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

Other suitable organometallic compounds may include ferric acetylacetonate.

Suitable alkali metal salts may be selected from the following:

calcium carbonate, salts of carbonic acid, and salts of acetic acid.

One supplier of the above catalysts (as mixtures or single compounds) is Air Products, South Africa, and the catalysts may be identified inter alia by the following trade marks/brands and/or acronyms, respectively.

<u>CHEMICAL BRAND NAME</u>	<u>ACTIVE INGREDIENT(S)</u>
DMEA	2-dimethyl ethanolamine
DABCO	<u>Di-amino bicyclo-octane</u>
POLYCAT 8 (DMCIA)	N,N-dimethyl cyclohexylamine
DABCO R-8020	Triethylenediamine and Dimethylethanolamine
DABCO DC-1	Tin and amine complexes
DABCO DC-2	Tin and amine complexes
DABCO K-15	Potassium octate and diethylene glycol
DABCO TMR 2	Quaternary ammonium salt in ethylene Glycol
THORCAT 401	Di-N-butyltindilaurate

When used with one or more of the above catalysts, the amount of MDI required to effect a suitable hastening of the curing process may preferably be in the range of about 0.1% to 1.9% on bone dry wood (hereinafter referred to as "BDW").

According to another aspect of the present invention, there is provided an additive for a UF binding mixture for use in manufacturing chipboard, the additive including

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an effective amount of MDI and a catalyst, each as indicated above, and as otherwise described herein.

According to a further aspect of the present invention, there is provided a process for manufacturing chipboard, the process including the steps of adding to or using in a binding mixture consisting of urea-formaldehyde resin, an effective amount of MDI and a catalyst, each catalyst being as indicated above, or as otherwise herein described, or an additive, respectively, as herein described, and suitably mixing the binding mixture with wood particles and/or chips.

DETAILED DESCRIPTION OF THE INVENTION

The invention will now be described in greater detail by way of non-limiting example(s), with reference to the following:

1. LABORATORY TESTS

Laboratory tests were carried out by way of reasonable technical trials, by personnel of the applicant's wholly owned subsidiary namely Sappi Timber Industries (Proprietary) Limited on wood particles and chips as used for manufacturing chipboard in the factories of the aforementioned company. Using the aforementioned raw materials, binder mixtures of urea-formaldehyde resin as typically used in the aforementioned company's

production facilities were applied to the aforementioned particle chips, and compared with urea-formaldehyde mixtures including MDI, and further compared with mixtures of urea-formaldehyde with MDI and various catalysts as set out above.

The resulting mixtures of particles/chips and binder mixtures were pressed in a laboratory scale press to simulate plant production conditions, and curing times were measured. The boards were pressed at a head pressure of about 230 Bar and at a temperature of about 225°C.

Details of the mixtures added to the core-layer glue mixture of a 16mm chipboard, and the corresponding results are set out in Table 1 hereafter.

TABLE 1

MIXTURE ADDED TO UF RESIN	INCREASE IN PRODUCTION SPEED (%)
<u>PLAIN MDI</u>	
1.4% MDI (BDW) added to core-layer UF resin	18
<u>MDI + RELEASE AGENT</u>	
1.4% (on BDW) of MDI + 0.5% (on UF solids) internal release and wetting agent	34.6
<u>MODIFIED MDI</u>	
(a) 1.4% (on BDW) MDI modified with PPG diol MDI pre-polymer	44.3
(b) 1.4% (on BDW) MDI modified with P PPG Triol MDI pre-polymer	44.3
(c) 1.4% (on BDW) MDI modified with TDI	44.3
(d) 1.4% (on BDW) MDI modified with PPG Triol TDI pre-polymer	42.4

Table 1 continued on next page

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TABLE 1 (continued)

<u>MDI+ CATALYSTS</u>	
(a) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% DABCO TMR 2 catalyst	45.8
(b) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO K 15 catalyst	44.3
(c) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO DC 2 catalyst	44.3
(d) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DMCHA catalyst	42.3
(e) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO R8020 catalyst	42.3
(f) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) Thorcat catalyst	40.0
(g) 1.4% (on BDW) MDI modified with Polyethylene glycol MDI pre-polymer + 0.1% (on UF mass) DABCO DC 2 catalyst	42.8
(h) 0.5% (on BDW) MDI + 1.1% (on UF mass) DMEA catalyst	33.3
(i) 0.5% (on BDW) water emulsified MDI + 1.1% (on UF mass) DMEA catalyst	33.3

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In the aforementioned table, the brand name Dattolac R130 is a brand name for polyether polyol, which is sold by ICI (Imperial Chemical Industries). Similarly PPG diol MDI Pre-Polymer is the brand name for polypropylene glycol diol MDI pre-polymer and PPG triol TDI Pre-Polymer is the brand name for polypropylene glycol triol TDI pre-polymer.

The curing times for mixtures where typically 0.1% to 1.9% MDI and one or more of the abovementioned catalysts were added (on BDW), were the shortest.

The results of the above tests indicated that in all cases the binding mixtures with MDI and one or more catalysts resulted in a shorter curing period with the same or an increased binding strength.

It was also found that the use of amines as catalysts alone resulted in the least costly mixture and hence the most cost-effective process(es).

2. PRODUCTION-PLANT TRIALS

The aforementioned tests were repeated by way of reasonable technical trials, on two different production lines namely one using a single daylight

press and the other using a continuous press. Details of the mixtures used and the corresponding results are set out in Table 2 hereunder.

TABLE 2

MIXTURE ADDED TO UF RESIN	INCREASE IN PRODUCTION SPEED (%)
<u>CONTINUOUS PRESS</u> 0.5% (on BDW) water emulsifiable MDI + 1.1% (on UF mass) + DMEA catalyst	26
<u>SINGLE DAYLIGHT PRESS</u> 0.5% (on BDW) water emulsifiable MDI + 1% (on UF mass) + DMEA catalyst	14.3

The abovementioned production-line tests confirmed the aforementioned laboratory results, with improvements in or increased curing times of up to 26%.

It will therefore be seen from the aforementioned that a considerable improvement in curing times and hence in productivity may be possible by using the aforementioned invention. Such improvement also appears to be cost-effective relative to increased productivity and production on an industrial scale.

Although certain embodiments only of the invention have been described herein, it will be apparent to any person skilled in the art that other variations and/or modifications of the invention are possible. Such variations and/or modifications are therefore to be considered as falling within the spirit and scope of the invention as claimed hereinafter.

CLAIMS

1. A binding mixture for use in manufacturing chipboard, the mixture including urea-formaldehyde resin ("UF"), an effective amount of methyl diisocyanate ("MDI") and one or more polyurethane catalyst(s) being selected from the following:
 - (a) one or more amine compounds including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and/or alcohols; or
 - (b) one or more organometallic compounds of tin, bismuth, zinc, iron, and/or alkali metal salt(s); or
 - (c) suitable mixtures of (a) and (b) above.
2. A binding mixture as claimed in claim 1, wherein the MDI is water-emulsifiable.
3. A binding mixture as claimed in either claim 1 or claim 2, wherein the or each polyurethane catalyst(s) is/are (a) delayed-action catalyst(s).

4. A binding mixture as claimed in any one of the preceding claims, wherein an effective amount of toluene di-isocyanate ("TDI") is added to the MDI.
5. A binding mixture as claimed in any one of the preceding claims, wherein one or more internal wetting and release agents is/are added to the mixture.
6. A binding mixture as claimed in any one of the preceding claims, wherein a suitable quantity of one or more than one polyol(s) is/are added.
7. A binding mixture as claimed in any one of the preceding claims, wherein the amount of formaldehyde in the UF may be approximately 50% (in moles).
8. A binding mixture as claimed in any one of the preceding claims, wherein the or each suitable amine(s) or amine compound(s) are selected from the following:

2-dimethyl ethanolamine ("DMEA");

di-amino bicyclo-octane ("DABCO"); and

N,N-dimethyl cyclohexylamine ("DMCHA").

9. A binding mixture as claimed in any one of the preceding claims, wherein the or each suitable organometallic tin-based compound(s) is/are selected from the following:

Stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

10. A binding mixture as claimed in any one of the preceding claims, wherein the suitable organometallic compound(s) include ferric acetylacetonate.

11. A binding mixture as claimed in any one of the preceding claims, wherein the suitable alkali metal salt(s) are selected from the following:

calcium carbonate, salts of carbonic acid, and salts of acetic acid.

12. A binding mixture as claimed in any one of the preceding claims, wherein the amount of MDI required to effect a suitable hastening of the curing process is in the range of from about 0.1% to 1.9% of bone dry wood ("BDW").

13. An additive for a UF binding mixture for use in manufacturing chipboard, the additive including an effective amount of MDI and a catalyst, each catalyst being as claimed in any one of the preceding claims.

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14. A process for manufacturing chipboard, the process including the steps of using a binding mixture as claimed in any one of claims 1 to 12, and suitably mixing the binding mixture with wood particles and/or chips.
15. A process for manufacturing chipboard, the process including the steps of adding to or using in a UF binding mixture an effective amount of an additive as claimed in claim 13, and suitably mixing the binding mixture with wood particles and/or chips.
16. Chipboard whenever manufactured by using a binding mixture, an additive for a binding mixture, or a process for manufacturing chipboard, respectively, as claimed in any one of the preceding claims.

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TIMBER PROCESS AND PRODUCT

INTRODUCTION

This invention relates to a timber process and product. More particularly this invention relates to a process for manufacturing so-called particle board or chipboard, and to a timber product in the form of such particle board or chipboard when manufactured by or from the aforementioned process.

BACKGROUND TO THE INVENTION

It is known in the manufacture of particle board or chipboard (hereinafter referred to as "chipboard") that a urea-formaldehyde resin (hereinafter referred to as "UF") is used as a binder or adhesive to bond the particles or chips of wood.

Typically such binders contain approximately 55% to 60% formaldehyde (in moles) but because of recent awareness of the health problems associated with the use of formaldehyde, the amount of formaldehyde in such resins is generally being reduced. Hence the amount of formaldehyde in the aforementioned resins has been reduced to approximately 50% or less (in moles).

The aforementioned resins need to be cured, and the curing process is accelerated by heating in a press under pressure i.e. heat is applied by hot metal platens on both sides of a so-called mat of glued chips. Such chipboard pressing takes place either in a batch-type (using daylight presses) or in a continuous process i.e. using continuous (for example roller) presses.

If it is also known in the chipboard industry that isocyanates especially methyl diisocyanate (hereinafter referred to as "MDI") may be added to the aforementioned type of resin to hasten the curing process i.e. to effectively increase the speed of the curing process and hence to reduce the curing time. However, because of the high cost of MDI and the amount required to effectively hasten the curing process, the use of MDI is not cost-effective on an industrial scale.

OBJECTS OF THE INVENTION

It is accordingly a general object of the present invention to provide an improved binding mixture for chipboard manufacture.

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It is also an object of the present invention to provide an improved process in which such improved mixture is used, which is both cost-effective and which increases the efficiency and rate of curing of the binding mixture.

It is a further object of the invention that the aforementioned binding mixture and process will lead to an increase in productivity or production flowing from shorter curing periods resulting from use of the aforementioned binding mixture.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a binding mixture for use in manufacturing chipboard, the mixture including UF, an effective amount of MDI and one or more polyurethane catalyst(s) being selected from the following:

- (a) one or more amine compound(s) including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and/or alcohols; or
- (b) one or more organometallic compound(s) of tin, bismuth, zinc, iron and/or alkali metal salt(s); or
- (c) suitable mixtures of (a) and (b) above.

The MDI may or may not be water-emulsifiable, and the or each polyurethane catalyst(s) may or may not be (a) delayed-action catalyst(s).

To the mixture may be added an effective amount of toluene di-isocyanate ("TDI") and/or one or more internal wetting and release agents.

The aforementioned mixture(s) may of course include a suitable amount of UF which may or may not have suitable quantities of polyol(s) added thereto. It is to be noted that the UF (with or without polyol(s), MDI and catalyst(s) mixture may be used as a core-layer glue mixture for a three-layer chipboard. The addition of isocyanate(s) and catalyst(s) to the core-layer glue mixture does not imply that the normal additives added to the UF (such as hardeners and wax) need to be excluded from the mixture. A surface layer glue mixture may consist of UF, hardener, wax and any other suitable additive(s) which either control tack or pre-curing of the glued wood chips.

The amount of formaldehyde in the aforementioned urea-formaldehyde resin may preferably be approximately 50% (in moles) i.e. may be less than, equal to, or more than 50% (in moles).

By using a catalyst as aforementioned, the effective amount of MDI required may be reduced relative to amounts known to be used in the prior art. In addition, by using a suitable catalyst as aforementioned, the rate of production of chipboard

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may be improved considerably as compared to performance by other formulations forming part of the prior art."

Suitable amines or amine compounds may be selected from the following:

2-dimethyl ethanolamine (hereinafter referred to as "DMEA");

di-amino bicyclo-octane (hereinafter referred to as "DABCO"); and

N,N-dimethyl cyclohexylamine (hereinafter referred to as "DMCHA").

Suitable organometallic tin-based compounds may be selected from the following:

stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

Other suitable organometallic compounds may include ferric acetylacetonate.

Suitable alkali metal salts may be selected from the following:

calcium carbonate, salts of carbonic acid, and salts of acetic acid.

One supplier of the above catalysts (as mixtures or single compounds) is Air Products, South Africa, and the catalysts may be identified inter alia by the following trade marks/brands and/or acronyms, respectively.

AMENDED SHEET

<u>CHEMICAL BRAND NAME</u>	<u>ACTIVE INGREDIENT(S)</u>
DMEA	2-dimethyl ethanolamine
DABCO	<u>Di-amino bicyclo-octane</u>
POLYCAT 8 (DMCIIA)	N,N-dimethyl cyclohexylamine
DABCO R-8020	Triethylenediamine and Dimethylethanolamine
DABCO DC-1	Tin and amine complexes
DABCO DC-2	Tin and amine complexes
DABCO K-15	Potassium octate and diethylene glycol
DABCO TMR 2	Quaternary ammonium salt in ethylene Glycol
THORCAT 401	Di-N-butyltindilaurate

When used with one or more of the above catalysts, the amount of MDI required to effect a suitable hastening of the curing process may preferably be in the range of about 0.1% to 1.9% on bone dry wood (hereinafter referred to as "BDW").

According to another aspect of the present invention, there is provided an additive for a UF binding mixture for use in manufacturing chipboard, the additive including

an effective amount of MDI and a catalyst, each as indicated above, and as otherwise described herein.

According to a further aspect of the present invention, there is provided a process for manufacturing chipboard, the process including the steps of adding to or using in a binding mixture consisting of urea-formaldehyde resin, an effective amount of MDI and a catalyst, each catalyst being as indicated above, or as otherwise herein described, or an additive, respectively, as herein described, and suitably mixing the binding mixture with wood particles and/or chips.

DETAILED DESCRIPTION OF THE INVENTION

The invention will now be described in greater detail by way of non-limiting example(s), with reference to the following:

1. LABORATORY TESTS

Laboratory tests were carried out by way of reasonable technical trials, by personnel of the applicant's wholly owned subsidiary namely Sappi Timber Industries (Proprietary) Limited on wood particles and chips as used for manufacturing chipboard in the factories of the aforementioned company. Using the aforementioned raw materials, binder mixtures of urea-formaldehyde resin as typically used in the aforementioned company's

production facilities were applied to the aforementioned particle chips, and compared with urea-formaldehyde mixtures including MDI, and further compared with mixtures of urea-formaldehyde with MDI and various catalysts as set out above.

The resulting mixtures of particles/chips and binder mixtures were pressed in a laboratory scale press to simulate plant production conditions, and curing times were measured. The boards were pressed at a head pressure of about 230 Bar and at a temperature of about 225°C.

Details of the mixtures added to the core-layer glue mixture of a 16mm chipboard, and the corresponding results are set out in Table 1 hereafter:

TABLE 1

MIXTURE ADDED TO UF RESIN	INCREASE IN PRODUCTION SPEED (%)
<u>PLAIN MDI</u> 1.4% MDI (BDW) added to core-layer UF resin	18
<u>MDI + RELEASE AGENT</u> 1.4% (on BDW) of MDI + 0.5% (on UF solids) internal release and wetting agent	34.6
<u>MODIFIED MDI</u> (a) 1.4% (on BDW) MDI modified with PPG diol MDI pre-polymer (b) 1.4% (on BDW) MDI modified with P PPG Triol MDI pre-polymer (c) 1.4% (on BDW) MDI modified with TDI (d) 1.4% (on BDW) MDI modified with PPG Triol TDI pre-polymer	44.3 44.3 44.3 42.4

Table 1 continued on next page

TABLE 1 (continued)

<u>MDI+ CATALYSTS</u>	
(a) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% DABCO TMR 2 catalyst	45.8
(b) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO K 15 catalyst	44.3
(c) 1.4% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO DC 2 catalyst	44.3
(d) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DMCHA catalyst	42.3
(e) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) DABCO R8020 catalyst	42.3
(f) 1.2% (on BDW) MDI modified with PPG Triol MDI pre-polymer + 0.1% (on UF mass) Thorcat catalyst	40.0
(g) 1.4% (on BDW) MDI modified with Polyethylene glycol MDI pre-polymer + 0.1% (on UF mass) DABCO DC 2 catalyst	42.8
(h) 0.5% (on BDW) MDI + 1.1% (on UF mass) DMEA catalyst	33.3
(i) 0.5% (on BDW) water emulsified MDI + 1.1% (on UF mass) DMEA catalyst	33.3

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In the aforementioned table, the brand name Daltolac R130 is a brand name for polyether polyol, which is sold by ICI (Imperial Chemical Industries). Similarly PPG diol MDI Pre-Polymer is the brand name for polypropylene glycol diol MDI pre-polymer and PPG triol TDI Pre-Polymer is the brand name for polypropylene glycol triol TDI pre-polymer.

The curing times for mixtures where typically 0.1% to 1.9% MDI and one or more of the abovementioned catalysts were added (on BDW), were the shortest.

The results of the above tests indicated that in all cases the binding mixtures with MDI and one or more catalysts resulted in a shorter curing period with the same or an increased binding strength.

It was also found that the use of amines as catalysts alone resulted in the least costly mixture and hence the most cost-effective process(es).

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The aforementioned tests were repeated by way of reasonable technical trials, on two different production lines namely one using a single daylight

press and the other using a continuous press. Details of the mixtures used and the corresponding results are set out in Table 2 hereunder.

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<u>SINGLE DAYLIGHT PRESS</u> 0.5% (on BDW) water emulsifiable MDI + 1% (on UF mass) + DMEA catalyst	14.3

The abovementioned production-line tests confirmed the aforementioned laboratory results, with improvements in or increased curing times of up to 26%.

It will therefore be seen from the aforementioned that a considerable improvement in curing times and hence in productivity may be possible by using the aforementioned invention. Such improvement also appears to be cost-effective relative to increased productivity and production on an industrial scale.

Although certain embodiments only of the invention have been described herein, it will be apparent to any person skilled in the art that other variations and/or modifications of the invention are possible. Such variations and/or modifications are therefore to be considered as falling within the spirit and scope of the invention as claimed hereinafter.

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- (a) one or more amine compounds including aliphatic and aromatic tertiary amine derivatives of phenols, esters, ethers, alkenes and/or alcohols; or
 - (b) one or more organometallic compounds of tin, bismuth, zinc, iron, and/or alkali metal salt(s); or
 - (c) suitable mixtures of (a) and (b) above.
2. A binding mixture as claimed in claim 1, wherein the MDI is water-emulsifiable.
3. A binding mixture as claimed in either claim 1 or claim 2, wherein the or each polyurethane catalyst(s) is/are (a) delayed-action catalyst(s).

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9. A binding mixture as claimed in any one of the preceding claims, wherein the or each suitable organometallic tin-based compound(s) is/are selected from the following:

Stannous octoate, dibutyl tin dilaurate, dibutyl tin mercaptide, dibutyl tin thiocarboxylate, and dioctyl tin thiocarboxylate.

10. A binding mixture as claimed in any one of the preceding claims, wherein the suitable organometallic compound(s) include ferric acetylacetonate.

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12. A binding mixture as claimed in any one of the preceding claims, wherein the amount of MDI required to effect a suitable hastening of the curing process is in the range of from about 0.1% to 1.9% of bone dry wood ("BDW").

13. An additive for a UF binding mixture for use in manufacturing chipboard, the additive including an effective amount of MDI and a catalyst, each catalyst being as claimed in any one of the preceding claims.

14. A process for manufacturing chipboard, the process including the steps of using a binding mixture as claimed in any one of claims 1 to 12, and suitably mixing the binding mixture with wood particles and/or chips.
15. A process for manufacturing chipboard, the process including the steps of adding to or using in a UF binding mixture an effective amount of an additive as claimed in claim 13, and suitably mixing the binding mixture with wood particles and/or chips.
16. Chipboard whenever manufactured by using a binding mixture, an additive for a binding mixture, or a process for manufacturing chipboard, respectively, as claimed in any one of the preceding claims.

MERCHANT & GOULD P.C.

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **TIMBER PROCESS AND PRODUCT**

The specification of which

- a. ☐ is attached hereto
b. ☒ was filed on _____ as application serial no. _____ and was amended on _____ (if applicable) (in the case of a PCT-filed application) described and claimed in international no. PCT/ZA00/00019 filed February 8, 2000 and as amended on March 16, 2001 (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

- a. ☐ no such applications have been filed.
b. ☒ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
South Africa	99/0969	8 February 1999	
ALL FOREIGN APPLICATION(S), IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)

I acknowledge the duty to disclose information that is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (reprinted below):

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim;

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application:

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

(e) In any continuation-in-part application, the duty under this section includes the duty to disclose to the Office all information known to the person to be material to patentability, as defined in paragraph (b) of this section, which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

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I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Albrecht, John W.	Reg. No. 40,481	Larson, James A.	Reg. No. 40,443
Ali, M. Jeffer	Reg. No. 46,359	Leonard, Christopher J.	Reg. No. 41,940
Altera, Allan G.	Reg. No. 40,274	Liepa, Mara E.	Reg. No. 40,066
Anderson, Gregg I.	Reg. No. 28,828	Lindquist, Timothy A.	Reg. No. 40,701
Batzli, Brian H.	Reg. No. 32,960	Lown, Jean A.	Reg. No. P-48,428
Beard, John L.	Reg. No. 27,612	Mayfield, Denise L.	Reg. No. 33,732
Berns, John M.	Reg. No. 43,496	McDonald, Daniel W.	Reg. No. 32,044
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Brown, Jeffrey C.	Reg. No. 41,643	Mueller, Douglas P.	Reg. No. 30,300
Bruess, Steven C.	Reg. No. 34,130	Nelson, Anna M.	Reg. No. P-48,935
Byrne, Linda M.	Reg. No. 32,404	Parsons, Nancy J.	Reg. No. 40,364
Campbell, Keith	Reg. No. 46,597	Pauly, Daniel M.	Reg. No. 40,123
Carlson, Alan G.	Reg. No. 25,959	Phillips, John B.	Reg. No. 37,206
Caspers, Philip P.	Reg. No. 33,227	Pino, Mark J.	Reg. No. 43,858
Clifford, John A.	Reg. No. 30,247	Prendergast, Paul	Reg. No. 46,068
Cook, Jeffrey	Reg. No. P-48,649	Pytel, Melissa J.	Reg. No. 41,512
Daignault, Ronald A.	Reg. No. 25,968	Qualey, Terry	Reg. No. 25,148
Daley, Dennis R.	Reg. No. 34,994	Reich, John C.	Reg. No. 37,703
Dalglish, Leslie E.	Reg. No. 40,579	Reiland, Earl D.	Reg. No. 25,767
Daulton, Julie R.	Reg. No. 36,414	Roberts, Fred	Reg. No. 34,707
DeVries Smith, Katherine M.	Reg. No. 42,157	Samuels, Lisa A.	Reg. No. 43,080
DiPietro, Mark J.	Reg. No. 28,707	Schmaltz, David G.	Reg. No. 39,828
Doscotch, Matthew A.	Reg. No. P-48,957	Schuman, Mark D.	Reg. No. 31,197
Edell, Robert T.	Reg. No. 20,187	Schumann, Michael D.	Reg. No. 30,422
Epp Ryan, Sandra	Reg. No. 39,667	Scull, Timothy B.	Reg. No. 42,137
Glance, Robert J.	Reg. No. 40,620	Sebald, Gregory A.	Reg. No. 33,280
Goggin, Matthew J.	Reg. No. 44,125	Skoog, Mark T.	Reg. No. 40,178
Golla, Charles E.	Reg. No. 26,896	Spellman, Steven J.	Reg. No. 45,124
Gorman, Alan G.	Reg. No. 38,472	Stoll-DeBell, Kirstin L.	Reg. No. 43,164
Gould, John D.	Reg. No. 18,223	Sullivan, Timothy	Reg. No. 47,981
Gregson, Richard	Reg. No. 41,804	Sumner, John P.	Reg. No. 29,114
Gresens, John J.	Reg. No. 33,112	Swenson, Erik G.	Reg. No. 45,147
Hammer, Samuel A.	Reg. No. 46,754	Tellekson, David K.	Reg. No. 32,314
Hamre, Curtis B.	Reg. No. 29,165	Trembath, Jon R.	Reg. No. 38,344
Harrison, Kevin C.	Reg. No. 46,759	Tunheim, Marcia A.	Reg. No. 42,189
Hertzberg, Brett A.	Reg. No. 42,660	Underhill, Albert L.	Reg. No. 27,403
Hillson, Randall A.	Reg. No. 31,838	Vandenburgh, J. Derek	Reg. No. 32,179
Holzer, Jr., Richard J.	Reg. No. 42,668	Wahl, John R.	Reg. No. 33,044
Hope, Leonard J.	Reg. No. 44,774	Weaver, Karrie G.	Reg. No. 43,245
Jardine, John S.	Reg. No. P-48,835	Welter, Paul A.	Reg. No. 20,890
Johnston, Scott W.	Reg. No. 39,721	Whipps, Brian	Reg. No. 43,261
Kadievitch, Natalie D.	Reg. No. 34,196	Whitaker, John E.	Reg. No. 42,222
Kaseburg, Frederick A.	Reg. No. 47,695	Wier, David D.	Reg. No. P-48,229
Kettelberger, Denise	Reg. No. 33,924	Williams, Douglas J.	Reg. No. 27,054
Keys, Jeramie J.	Reg. No. 42,724	Withers, James D.	Reg. No. 40,376
Knearl, Homer L.	Reg. No. 21,197	Witt, Jonelle	Reg. No. 41,980
Kowalchuk, Alan W.	Reg. No. 31,535	Wu, Tong	Reg. No. 43,361
Kowalchuk, Katherine M.	Reg. No. 36,848	Young, Thomas	Reg. No. 25,796
Lacy, Paul E.	Reg. No. 38,946	Zeuli, Anthony R.	Reg. No. 45,255

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

I understand that the execution of this document, and the grant of a power of attorney, does not in itself establish an attorney-client relationship between the undersigned and the law firm Merchant & Gould P.C., or any of its attorneys.

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PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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